

Energy Conservation: Do it in a Big Way The Right Way

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"Fred Hutch".....

- Est. 25 yrs ago
- 12 yrs in current location
- 1.2 million gsf developed
- 550,000 gsf labs
- 2.1 million gsf build out potential



....and Me

- 15 years in consulting engineering
- Commercial and industrial mechanical design
- Energy surveys of over 100 facilities
- 6 years at Fred Hutch

Energy Program Numbers To Date

- 40 projects completed or in process-4 yrs
- \$820,000 annual energy savings to date
- \$2 million in incentive funding
- Energy projects ranging from \$250 to \$550,000

FHCRC Energy Awards-Local

- 2000 Power Player Award
(Seattle City Light)
- 2001 Power Player Award
(Seattle City Light)
- 2002 Energy Conservation Award
(Business and Industry Resource Venture)
- 2002 Environmental Leadership Award
(Business and Industry Resource Venture)

Energy Awards-State & National

- 2001 Environmental Excellence Award
(Association of Washington Businesses)
- 2002 Achievement in Energy Efficiency
by an End User
(Association of Energy Services Professionals)

Presentation Scope

- Research lab energy focus
- Selected projects for discussion
- What worked
- What didn't
- What we learned

Energy Focus

Research labs consume 10 to 20 times the energy and water as a standard office building

- 100% outside air
- High air change rates
- Water intensive processes

Biggest Bang.....

- 1) Reduce air change rates
- 2) Reduce unoccupied air change rates
- 3) Night temperature setback / setup
- 4) Fan energy reductions
(i.e. VSD's, duct static pressure)

Biggest Bang....

- 5) Heat recovery from process cooling water
- 6) Reduce city water tempering
(sterilizers and washer areas)
- 7) Washer area heat recovery
- 8) Ventilation heat recovery

Convert to Interruptible Rate

- Firm gas rate structure since 1992
- 10,000 gal diesel storage/dual fired boilers
- Obtained bids from 3 gas marketers
- Curtailment occurs 2 - 7 days/yr ave
- \$2/therm/day penalty

Ann Sav: \$71,000
Utility Incentive: \$0

Cost: \$1000
Payback: One Week

Reflecting....

- Increased fuel turnover
- Higher state of readiness
- Special fuel supply arrangement
- Utility incentive funding impact
- "Paid the penalty"
- Combine natural gas meters

L.E.D. Exit Signs

- 470 fluorescent exit signs - 7 yrs old
- Numerous lamp and ballast failures
- Maintenance driven
- L.E.D. signs consume 1/10th the energy

Ann sav:\$3210

Cost: \$21,000

Utility incentive: \$8,200

Payback: 4 yrs

Looking back....

- 1-1/2 year implementation
- Dual voltage units wired incorrectly
- Premature failures
- consider specialized retrofit contractors

Frog Tank Cooling/Filtration

- City water used for cooling/refreshing tanks
- 1.5 gpm req'd/2.0 gpm delivered (to drain)
- Water tempering control valve improperly sized
- Filters manually changed once/day in spring
- Maintenance driven
- Added new auto flush filters/tempering valve
- 0.5 gpm saved and many labor hours

Ann sav: \$2,100

Cost: \$9,500

Utility incentive: \$0

Payback: 4.6 yrs

Up and down sides...

- Improved cooling, controllability & filtration
- reduced maintenance
- Added complexity
- Equipment incorrectly specified
- Incentive opportunity missed

Reduce Lab Min. A.C. Rate to 6

- Phase I design at 10 air changes min.
- Current standards allow 6 air changes min.
- Trending analysis found most VAV boxes at mins.
- No equipment req'd - reprogramming only

Ann sav:\$86,700

Cost: \$1,600

Utility incentive: \$0

Payback: one week

Hindsight...

- Program changes at "front end" also
- Some boxes already at minimums
- A few boxes oversized and unstable

Variable Volume Variable Pressure

- Cutting edge control strategy developed by SBT
- Std VAV systems use constant supply S.P.
- VVVP modulates supply pressure to minimize duct pressure and satisfy most remote box
- 13 major lab air handlers retrofitted
- Ave supply pressures reduced from 2.0 to 1.1 S.P.

Variable Volume Variable Pressure

(Continued)

Phase I - 7 AHU's Retrofitted:

- Replaced inlet volume control with VSD's
- Incorporated variable pressure control

Phase II - 6 AHU's Retrofitted:

- Newer facility already had VSD's
- Incorporated variable pressure control

Ann sav: \$153,000

Cost: \$530,000

Utility incentive: \$443,000

Payback: 7 months

Variable Volume Variable Pressure (Continued)

- Trended before and after implementation to verify electrical savings



Lessons...

- Propriety product - competitive bids not an option
- 70% incentive funding dependent upon project start and completion
- Change orders excluded from incentive funding
- Careful review of contractor's scope
- Future changes require new duct system model from control's contractor
- Monitor and alarm duct S.P. parameters

Washer Heat Recovery

- Glass & cage washers and sterilizers discharge hot water to drain
- City water tempering to 140 deg. F.
- Installed shell & tube heat exchangers for domestic water preheating
- Eliminated city water tempering
- Saves gas, water and sewer

Ann sav: \$34,600

Cost: \$110,000

Utility incentive: \$32,000

Payback: 2.3 yrs

Washer Heat Recovery



Good and bad...

- Energy audit budget - \$64,000.
- Actual cost - \$110,000
- Include design fees, tax & contingencies
- Original design had several flaws
- Additional instrumentation and features for monitoring

Off Hour Temperature and Air Change Reduction

- 10 yr old Phase I facility: Night temperature setback capability, but no local override stats
- Adding local stats for temperature reduction only not cost effective
- Incorporating off hour ventilation reduction to 4 A.C. increased savings and incentives
- New current sensors in room lighting circuits determine off hour schedule

Ann sav: \$55,700

Cost: \$144,200

Utility incentive: \$91,000

Payback: 1 yr

Yin and yang...

- Impact on staff
- Solicited support beforehand
- Lighting outages occurred
- Operating Engineers on standby

Process Cooling Water Heat Recovery

- PCW system at 85 deg F. rejects heat to cooling tower on roof
- Preheat coils added to 2 AHU's
- Added VSD to pump
- New control strategy determines when to recover or reject heat
- Cooling tower off 6 months per year
- Pump energy and gas heating reduced

Ann sav: \$21,600

Cost: \$76,000

Utility incentive: \$43,100

Payback: 1.5 yrs

Good, bad and ugly....

- Recover heat to 2 AHU's
- Complex control strategy
- Reused existing heating coil in lieu of new recovery coil
- Instrumentation for sustainability
- Trended operating parameters to assure proper operation
- Monitoring and alarms

VSD - Vivarium Air Handler

- Revise inlet cone control to VSD
- 2 redundant 150 HP motors @ 3,000 lb ea
- 20 minute max allowable outage
- \$65,000 cost with \$37,000 incentive
- 3.5 year payback

Ooops...project cancelled

- First obtain management buyoff
- Balance benefit against risk
- Other drivers may resurrect project
- Retained and redirected FHCRC & incentive funding to other ECM's

Pearls of Wisdom

- Commission new energy saving systems
- Implement sustainable measures
- Don't rely entirely upon consultants
- Stay involved during implementation

More Pearls of Wisdom

- Include contingencies in estimates
- Maintain energy program visibility
- Consider in-house vs specialized retrofit contractors
- Don't be the Lone Ranger

Even More Pearls of Wisdom

- Carefully review contractor proposals (re: energy saved and construction methods)
- Take informed risks
- Combine energy projects with maintenance benefits
- Research facilities have an energy footprint of 10 to 20 times the average building

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Fred Hutchinson Cancer Research Center



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